A Nomograph for Predicting Water Temperature in Eastern Washington Streams

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In 1992, the Washington State Forest Practices Board (FPB) adopted forest practices regulations in an effort to bring forest practices rules into compliance with State Water Quality Standards. Included in these regulations were state-wide temperature prediction nomographs that were designed to assist landowners, other interested parties and federal, state, and tribal agencies in determining proper shade levels to be maintained along streams to protect stream temperature. These nomographs used elevation and shade as the predictors for stream temperature. In 1993, separate temperature prediction nomographs were developed for eastern Washington conditions. The temperature prediction nomographs that were developed in the 1990s were specific to the State Water Quality Standards of 16.0 ^{o}C for Class AA (extraordinary water quality) streams and 18.0 ^{o}C for Class A (excellent water quality) streams. The eastern Washington nomographs were subsequently incorporated into the new forest practices rules adopted in May, 2001. At the time of their adoption into the new rules, a need to update the eastside nomographs with additional information was identified. This project addresses that need.

Existing stream temperature data was collected from a agencies, tribes, landowners, and others. All data used in the analyses needed to include at least a measure of summer maximum temperature, canopy closure, and a site location and/or elevation. Additional data was for each site was also requested where available. This additional data included stream flow, bank full width and depth, drainage area, annual precipitation, hillslope gradient distance to the watershed divide, channel aspect, and air temperature. The additional data was available for only a handful of sites. GIS analysis and existing GIS coverages were used to estimate values for all these attributes except stream flow and bank full width and depth. Regression analyses were conducted to identify the independent variables that had the greatest effect on stream temperature and to develop equations that could be used to develop updated eastern Washington nomographs. Data analyses were stratified by geographic region, ecoregion, and lithology.

In many cases, the strength of the relationships developed was affected by sample size or the distribution of available samples across the independent variables. In the Blue Mountains, location was not available; hence the GIS based variables could not be derived.

The majority of the regression equations found canopy closure and either basin size or distance from divide as the primary variables explaining the variance in stream temperature in each strata. Earlier studies conducted in the 1990s also found distance from divide to be a primary driving variable. The results suggest a primary relationship between stream temperature and stream flow, which is modified by canopy closure. This study is not yet complete and the results have not been reviewed.

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